Міністерство освіти і науки України

Житомирський державний університет імені Івана Франка

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English for Chemistry Students

Посібник-практикум для студентів природничого факультету спеціальності «Хімія»

Житомир

Вид-во ЖДУ ім. Івана Франка

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Посібник-практикум містить матеріал, необхідний для проведення практичних занять та організації самостійної роботи з англійської мови студентів-хіміків природничого факультету. Тексти та вправи подані для виконання шести змістових модулів. Матеріал розрахований на поглиблення фахових спеціальних та загальних комунікативних навичок студентів у процесі професійно спрямованого вивчення англійської мови.

Розрахований на студентів денної та заочної форми навчання.

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CONTENTS

ПЕРЕДМОВА

Посібник-практикум «English for Chemistry Students» («Англійська для студентів-хіміків») призначений для студентів природничого факультету спеціальності «Хімія». Його метою є вдосконалення навичок усного та писемного мовлення за допомогою автентичних текстів для читання, укладених відповідно до тематики вивчення курсу «Іноземна мова» на вказаному факультеті.

Посібник-практикум відповідає програмі вивчення іноземної мови на природничому факультеті і вимогам необхідного кваліфікаційного рівня. Матеріал поділено на шість розділів, тексти яких охоплюють інформацію про: науку хімію, історію розвитку хімії, Д.І. Менделєєва, періодичну систему елементів, хімічні елементи та сполуки, матерію та молекули.

Кожний розділ складається з тексту, який містить спеціальну наукову термінологію, та лексичних дотекстових, текстових та післятекстових вправ, за допомогою яких формуються навички говоріння, читання, письма, розуміння англійських текстів в межах поданих тем. Вправи дають змогу студентам закріпити нову лексику та розвивають вміння використовувати її в усному та писемному мовленні.

Сучасні матеріали посібника відповідають змінам у сфері хімії. Зі швидким розвитком інформаційних технологій змінюється і роль хімічної промисловості у сучасному світі. За таких умов виникає потреба в оволодінні новою фаховою термінологією та вмінням вільно використовувати її у галузі хімії в актах комунікації фахового характеру та під час перекладу фахових текстів українською мовою.

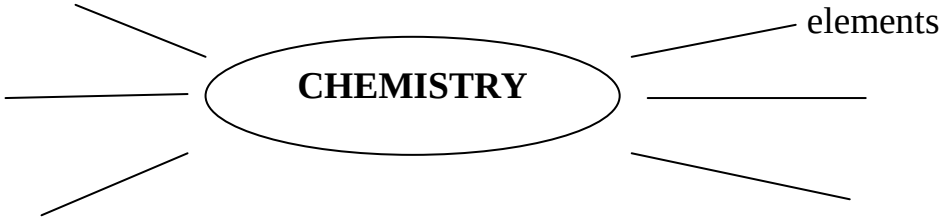
Unit 1

CHEMISTRY AS A SCIENCE

1. Work in pairs and discuss the following questions:

1. How would you define chemistry?
2. What branches of chemistry do you know?
3. What is the purpose of studying chemistry?
4. Think of the word *chemistry*. What comes to your mind?

Complete the chart and share your ideas with your fellow students:



2. Pronounce the following words.

1) Chemistry, chemical, chemist.
2) Science, scientific, scientist.

3. Make sure that you know the pronunciation and translation of the following words and expressions from the text (use a dictionary):

deal with -
be concerned with -
branch -
compound -
obtain -
include -
carbon -
basic concept -
in existence -
involved in -
be flavored by -
be preserved by -
be manufactured by -

The Science of Chemistry

Chemistry is a science of the composition, properties and reactions of matter. Chemistry **deals with** the matter, its properties, how and why substances combine or

separate to form other substances, and how substances interact with energy. It **is concerned with** different forms of matter, such as water, salt, iron, sugar, oxygen, etc.

Chemistry is closely related to physics, biology and other sciences. Now there are more than 30 different **branches** of chemistry. Some of them are: inorganic chemistry, organic chemistry, physical chemistry, analytical chemistry, nuclear chemistry, colloidal chemistry and biochemistry.

Inorganic chemistry deals with substances **obtained** directly or indirectly from minerals, ores and similar sources. This branch studies inorganic **compounds**. It **includes** the study of the structure and properties of these compounds. It also includes the study of the individual elements of the compounds.

Organic chemistry deals with **carbon** and its compounds. There are millions of organic compounds, with thousands more discovered or created each year.

Doctors, nurses and veterinarians must study chemistry, but understanding **basic** chemistry **concepts** is important for almost every profession. Chemistry is part of everything in our lives.

Every material **in existence** is made up of matter — even our own bodies. Chemistry is **involved in** everything we do, from growing and cooking food to cleaning our homes and bodies to launching a space shuttle. The food you eat is colored, **flavored**, and **preserved by** various chemical additives. The cleaning supplies you use to keep your house clean are **manufactured by** large chemical firms. The bug killers you use to keep cockroaches from overrunning your kitchen are made in giant labs. Modern life simply wouldn’t be possible without the use of chemistry. Chemistry helps us to describe and explain our world.

4. Read the text and find English equivalents to the following Ukrainian phrases. Use them in the sentences of your own.

Властивості матерії; галузь хімії; взаємодіяти з енергією; форми матерії; неорганічні сполуки; тісно пов'язаний; створений з матерії; запускати космічний корабель; хімічні домішки; миючі засоби; засоби проти комах.

5. Answer the following questions

1. What is chemistry?
2. What does chemistry deal with?
3. What forms of matter is chemistry concerned with?
4. How many branches of chemistry are there now? What are they?
5. What substances does inorganic (organic) chemistry deal with?
6. Is it important to study chemistry? Why?
7. Where do we use knowledge of chemistry?

6. Say if the statements are true or false.

1. Chemistry plays an important role in the life of modern world.
2. Chemists study the composition, the properties and the structure of the matter.
3. Chemistry isn't related to other sciences.
4. There are several branches of chemistry.
5. A lot of organic compounds are discovered every year.
6. Chemistry is important only for doctors, nurses and veterinarians.
7. Chemical plants produce supplies for keeping your house clean.
8. It is possible to live without the use of chemistry.

7. Fill in the gaps using appropriate words and expressions from the text.

1. Chemistry is a science that studies … of matter.
2. Chemistry is related to such … as biology and physics.
3. There are a lot of different … of chemistry.
4. Inorganic chemistry studies … .
5. Our food is flavored by various … .
6. People use … to keep their house clean.
7. Chemistry explains how and why substances … or … .
8. Organic chemistry deals with … .
9. Chemistry helps us to … our world.

8. Find the equivalents in the first and second columns

1. cleaning supplies	a) a division of science
2. chemistry	b) a quality or power, or effect that belongs naturally to smth.
3. composition	c) the arrangement of various parts of which smth. is made up
4. property	d) a chemical substance that is added to something such as food, to preserve it, give it colour, improve it etc.
5. matter	e) the science studying the substances which make up the Earth, the universe and living things
6. structure	f) the material that makes up the world and everything in space and can be seen or touched
7. substance	g) he way in which parts are formed into a whole
8. chemical additives	h) a material, type of matter
9. branch	i) supplies you use to keep your house clean (such as spray for the mirror, air fresheners, brushes, dusting, gloves, household cleaners, sponges, squeegees, trash bags).
10. bug killers	j) substance used for killing insects

9. Fill in prepositions:

1) Chemistry deals … the properties, composition and structure of the materials.

2) Chemistry is related … other sciences.

3) Chemistry is concerned … different forms of matter.

4) Inorganic chemistry studies substances which are obtained … minerals, ores and similar sources.

5) There are more than 30 different branches … chemistry.

6) Chemistry is part of everything … our lives.
7) Every material is made … of matter.
8) Chemistry is involved … everything we do.
9) Our food is colored, flavored, and preserved … various chemical additives.
10) Modern life wouldn’t be possible … the use of chemistry.

10. Work in pairs. Discuss the following statements:

1. Chemistry is a very complicated science.
2. Chemistry is closely related to physics, biology and other sciences.
3. Basic chemistry concepts are important for almost every profession.
4. Modern life simply wouldn’t be possible without the use of chemistry.

11. Give the summary of the text (7-10 sentences).

Vocabulary 1

additives [ˈ ædətɪ v] домішка
combine [kəmˈ bʌ ɪ n] поєднувати, об'єднувати
composition [kɒ mpəˈ zɪ ʃ (ə)n] структура, склад (хімічний)
discover [dɪ ˈ skʌ və] робити відкриття, виявляти
matter [ˈ matə] речовина, матеріал
nuclear [ˈ njuː klɪ ə] ядерний
ore [ɔ ː] руда
property [ˈ prɒ pəti] якість, властивість
separate [ˈ seprət] відокремлювати, роз’єднувати
source [sɔ ː s] джерело
substance [ˈ sʌ bst(ə)ns] речовина, субстанція

Unit 2

THE HISTORY OF CHEMISTRY

1. Work in pairs and discuss the following questions:

1. What do know about the history of chemistry?

2. Do you know any famous chemists from the past? What role did they play in the development of the science?

3. What were the purposes of ancient chemists?

2. Read the following words. Pay attention to the pronunciation.

derive [dɪ ˈ rʌ ɪ v] походити

ancient [ˈ eɪ nʃ ənt] древній, стародавній

embalmment [ɪ mˈ bɑ ː mənt] бальзамування

speculation [ˌ spekjuˈ leɪ ʃ n] припущення, гіпотеза

investigation [ɪ nˌ vɛ stɪ ˈ g eɪ ʃ (ə)n] дослідження, обстеження

combustion [kəmˈ bʌ stʃ (ə)n] окислення

convince [kənˈ vɪ ns] переконувати, запевняти

From the History of Chemistry

Many suggestions have been, made as to the origin of the word chemistry. One of them **derives** from the ancient name for Egypt, «khem» or «chem», which means "black" and was given to Egypt because of the dark soil of that country. We do not know if it is true. But we know that the **ancient** Egyptians knew more chemical operations than any other nation of antiquity, and that the Egyptian Science as a name for chemistry is very appropriate. Each nation of the ancient world contributed its share to the development of the science.

Metallurgy, glassmaking, dyeing, the manufacture of pigments and poisons, soap-making and **embalmment**, the preparation of drugs for medicinal purposes were the principal subjects of the ancient chemists.

The first theoretical chemistry was the chemistry of the Greek chemists (1000-600 B.C.). Pythagoras, Heraclitus, Hippocrates, Democritus, Plato, Aristotle made

chemical **speculations** and practical chemical observations. But the empirical chemical facts got by the Greeks were **obtained** by some men whose names have not come down to us. They were craftsmen-metal workers, dyers and the like.

The great chemists of the Middle Ages in Europe were Roger Bacon and Paracelsus. At that time chemistry the efforts of chemists were mainly directed to the preparation and **investigation** of drugs. This was the period of medical chemistry (1500–1700).

Robert Boyle defined an element as a substance that cannot be split up into other substances. He suggested that matter was composed of small particles of different shapes and sizes called atoms, combination and separation of which take place in chemical changes. His ideas had not the immediate great effect because chemists at that time studied a theory of **combustion** which was called the Phlogiston Theory (18-th century).

According to this Theory Antoine Lavoisier **convinced** that probably in all cases of combustion an increase of weight occurred. He also showed that a newly discovered gas, oxygen, was present in the atmosphere.

A few years later John Dalton made the greatest step in the history of chemistry by his work on the Atomic Theory.

3. What events or facts do the following numerals refer to?

1000-600 B.C., 1500–1700, 18-th century.

4. Read the text and find English equivalents to the following Ukrainian words and phrases. Use them in the sentences of your own.

Походження слова, темний ґрунт, єгипетська наука, зробити свій вклад, розвиток науки, виробництво фарб та отрут, скловаріння та миловаріння, фарбування тканин, виготовлення ліків, медичні цілі, спостереження, бути розділеним, частинки різної форми і розмірів, в усіх випадках окислення, збільшення ваги, щойно відкритий газ.

5. Read the text and make a plan of it giving titles to each paragraph.

6. Complete the following sentences:

1. The word chemistry derives from … .
2. Each nation of the ancient world … .
3. The principal subjects of the ancient chemists were … .
4. The chemistry of the Greek chemists was … .
5. The names of ancient craftsmen-metal workers, dyers and the like …
6. The great chemists of the Middle Ages in Europe were … .
7. The efforts of chemists in the Middle Ages were mainly directed to … .
8. Robert Boyle suggested that matter was composed of … .
9. A theory of combustion is called … .
10. Antoine Lavoisier convinced that… .

7. Answer the questions:

1. What is the origin of the word chemistry?
2. Why chemistry is sometimes called "the Egyptian Science"?
3. What were the principal subjects of the ancient chemists?
4. What was the purpose of chemistry in the Middle Ages?
5. What is the role of Robert Boyle in chemistry?
6. What is the Phlogiston Theory?

8. Match a word with its definition.

1. atom	a. the process of research, formal procedure of discovery.
2. combustion	b. preserve a dead body from decay by using chemicals.
3. investigation	c. have a share in.
4. observations	d. a substance that cannot be split up into other substances.
5. derive	e. collected or recorded information.
6. embalm	f. process of burning; chemical reaction between a fuel

7. drug	and an oxidant that produces oxidized products.
8. oxygen	g. new stage which is the result of developing.
9. contribute	h. gas in the atmosphere.
10. development	i. have as a source or origin.
	j. a chemical substance used to treat, cure.

9. Fill in the missing words from the box below:

speculations, atom, oxygen, particles, development, ancient, investigated, weight, pigments, theoretical

1. The manufacture of ... and poisons were the principal subjects of antiquity.

2. Greek chemists contributed their share to the … of chemistry.

3. A lot of … craftsmen-metal workers and dyers made their contribution to the science.

4. Pythagoras, Heraclitus and Hippocrates created the first … chemistry.

5. Greek chemists made chemical … and practical chemical observations.

6. In the period of medical chemistry chemists prepared and … drugs.

7. … is a substance that cannot be split up into other substances.

8. The matter is composed of small … called atoms.

9. An increase of … is occurred in all cases of combustion.

10. … is a gas present in the atmosphere.

10. Tell some sentences about:

- Egyptian chemists;
- Greek chemists;
- Roger Bacon and Paracelsus;
- Antoine Lavoisier;
- John Dalton.

11. Comment on the following items.

a) the origin of the word “chemistry”;

b) the main subjects of the ancient chemistry;

c) the period of medical chemistry;

d) the theory of combustion;

e) the Phlogiston Theory.

12. Make up a dialogue with your partner “An interview with a famous chemistry historian”. Use the following phrases:

I’d like to know what/when/why/how/who/if …

Could you tell me what/when/why/how/who/if …

I wonder what/when/why/how/who/if …

Would you tell me what/when/why/how/who/if …

It’s interesting to know what/when/why/how/who/if …

As far as I know/understand/can judge …

13. Find interesting information and make up a presentation “From the History of chemistry”.

Vocabulary 2

antiquity [an' tɪ kwɪ ti] стародавній світ

appropriate [ə' prəʊ priət] відповідний

split [splɪ t] розщеплювати

drug [' drʌ g] ліки, зілля

dyeing [daɪ ɪ ŋ] фарбувальна справа

immediate [ɪ ' miː dɪ ət] негайний

increase [ɪ n' kriː s] збільшувати, підвищувати,

observation [ɒ bzə' veɪ ʃ (ə)n] спостереження

occur [ə' kəː] траплятися, відбуватися

particle [' pɑ ː tɪ k(ə)l] частинка

poison [' pɔ ɪ z(ə)n] отрута

soap-making [səʊ p ' meɪ kɪ ŋ] миловаріння

soil [sɔ ɪ l] ґрунт

suggest [sə' dʒ ɛ st] пропонувати

suggestion [sə' dʒ ɛ stʃ (ə)n] пропозиція, порада

weight [weɪ t] вага

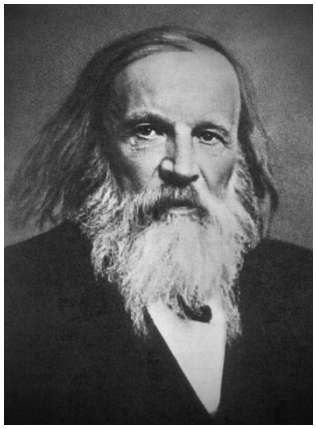
Unit 3

THE WORLD'S GREATEST CHEMIST

1. Look at the portrait of the famous scientist. Do you know him? Share the information with your fellow students.

2. Read the following words and say what Ukrainian words help to understand their meanings:

Periodic, system, element, history, genius, medal, characteristic, idea, calculation, modern, pedagogical, regulate, rudimentary, meteorology, vertical, horizontal, principle.



The World's Greatest Chemist
(1834–1907)

Dmitry Ivanovitch Mendeleyev is the great Russian scientist, the father of the Periodic Table of Elements. He was born in Siberia and was the last of 17 children. In the year of his birth his father **went blind**, and his mother leased and operated a glass factory **to keep the wolf from the door**. His father died and the glass factory burned down in 1848. Then his mother **headed for** Moscow with Dmitry and his sister. Her idea was to place the son in the University of Moscow, but he **was refused**. Later he entered the Pedagogical Institute in St. Petersburg and graduated from it with a gold medal.

After graduation Mendeleyev worked as a teacher for two years. Then he was sent to Germany to continue his education. While living abroad, he made a number of important investigations. When Mendeleyev returned to Russia he was elected professor of the Petersburg Technological Institute and two years later professor of the Petersburg University. This genius successfully dealt with problems in different areas, from mathematics and astronomy to meteorology, from philosophy to economics, from technology to art.

The great majority of scientists **were firmly convinced** that atoms of different elements were in no way connected with each other. Only a few scientists realized that there must be a general system of laws which regulates the behavior of atoms. However, their **attempts** to find such a system were unsuccessful. D.I. Mendeleyev made thousands of experiments and calculations. This work resulted in the Periodic Table of the Elements consisting of vertical and horizontal periods. The scientist described more than 60 elements. Mendeleyev applied in his system the principles that he developed and included in his table the listing of the elements **according to increasing weights**. He was able to **predict** not only the **existence** of a few unknown elements but their properties as well.

Mendeleyev **set down** his first ideas at breakfast, on a note he had received about a visit to a cheese factory that day. He **cancelled** the visit and worked on. He **drew up** several rudimentary tables and then made 63 cards, one for each of the known elements. On each card he put the properties of the element that he thought most important. He **juggled** the cards until he had an arrangement that satisfied him, wrote it down, and went to bed. He **awoke from his nap** with the idea that he should arrange the elements in vertical rather than horizontal groups and transposed them accordingly.

The government retired Mendeleyev from the University of St. Petersburg for his political activities. He was made head of the Bureau of Weights and Measures in 1893 and **held that post** until his death.

3. Look through the text and give the Ukrainian equivalents for the words in bald. Use a dictionary.

4. Give the English equivalents to the following:

Згоріти, вступити до інституту, закінчити інститут, продовжити навчання, жити за кордоном, зробити відкриття, переважна більшість, пов’язані між собою, система законів, розрахунки, описати, застосувати принципи, передбачати, впорядкувати елементи, відповідно.

5. Read the text and find the information about:

a) the family of Mendeleyev;

b) the studying of Mendeleyev;

c) the work of the famous scientist;

d) Mendeleyev's great discovery;

e) the first ideas about the Table;

f) the last days of Dmitry Ivanovitch.

6. Express your agreement or disagreement with the following statements.

1. Mendeleyev was born in a small family.

2. The scientist didn't enter the University of Moscow.

3. Mendeleyev was the only scientist who tried to arrange the elements.

4. Mendeleyev discovered the Table when he was sleeping.

5. A lot of new elements were predicted with the help of the periodic table.

6. The periodic system didn't change with time.

7. Mendeleyev was interested only in chemistry.

7. Fill in the blanks with prepositions where necessary.

in, to, from, for, at, after, up, with, of.

1. Dmitry Mendeleyev was born … Siberia and was the last … 17 children.
2. His mother leased and operated a glass factory to keep the wolf … the door.
3. His mother headed … Moscow with Dmitry and his sister.
4. Mendeleyev entered … the Pedagogical Institute in St. Petersburg and graduated … it with a gold medal.
5. … graduation Mendeleyev worked as a teacher … two years.
6. Mendeleyev successfully dealt … problems in different areas.
7. Atoms of different elements are connected … each other.
8. The work of Mendeleyev resulted … the Periodic Table of the Elements.
9. The Periodic Table of the Elements consists … vertical and horizontal periods.

10. Mendeleyev arranged the elements according … increasing weights.

11. Mendeleyev set down his first ideas … breakfast.

12. He drew … several rudimentary tables and then made 63 cards.

8. Make up sentences or short stories with the following words and expressions:

1) be born, family, year, father, mother.

2) be refused, Institute, enter, graduate from.

3) live abroad, make investigations, two years, different areas.

4) attempts, system of laws, calculations, elements, periodic system.

5) first ideas, cards, juggle, nap, arrange the elements.

6) head, hold the post, bureau, government, political activities.

9. Answer the following questions.

1. Where was D. I. Mendeleyev born?
2. Was his family rich?
3. Why did enter the Institute in St. Petersburg?
4. Where did he get his education?
5. How did Mendeleyev devise his periodic table?
6. What is importance of the periodic system of the elements?
7. Was he interested in other sciences?
8. Why do people call Mendeleyev “the greatest chemist of the world”?

10. Work in pairs. Discuss the following topics using the words and phrases from the box:

to my mind; I don’t think so; I agree with you; it’s (quite) right; it’s not right; sorry, you are wrong

1. The Discovery of the Periodic System of the Elements.

2. Mendeleyev’s Life.

3. Mendeleyev’s Interests.

4. The Periodic System of Elements at Present.

11. Give the summary of the text (7-10 sentences).

12. Think about a famous chemist. Prepare a report about his/her mark on chemistry. You may choose from the list below:

- Robert Boyle;
- Antoine Lavoisier;
- John Dalton;
- Michael Faraday;
- Alfred Nobel;
- Marie Curie.

Vocabulary 3

accordingly [ə' kɔ ː dɪ ŋli] відповідно

area [' eəriə] сфера, галузь

arrangement [weɪ t] розміщення, розстановка, систематизація

attempt [ə' tɛ m(p)t] спроба

burn [bɜ ː n] горіти, згоряти

connect [kə' nɛ kt] з'єднуватися, сполучатися

consist of [kən' sɪ st] складатися з

elect [ɪ ' lɛ kt] вибирати, обирати

genius [' dʒ iː nɪ əs] геній

include [ɪ n' kluː d] включати

law [lɔ ː] закон

lease [liː s] брати під оренду

majority [mə' dʒ ɒ rɪ ti] більшість

measure [' mɛ ʒ ə] вимірювати, міряти

regulate [ˈ rɛ ɡ jʊ leɪ t] регулювати, впорядковувати

rudimentary [ˌ ruː dɪ ˈ mɛ nt(ə)ri] недорозвинений, рудиментарний

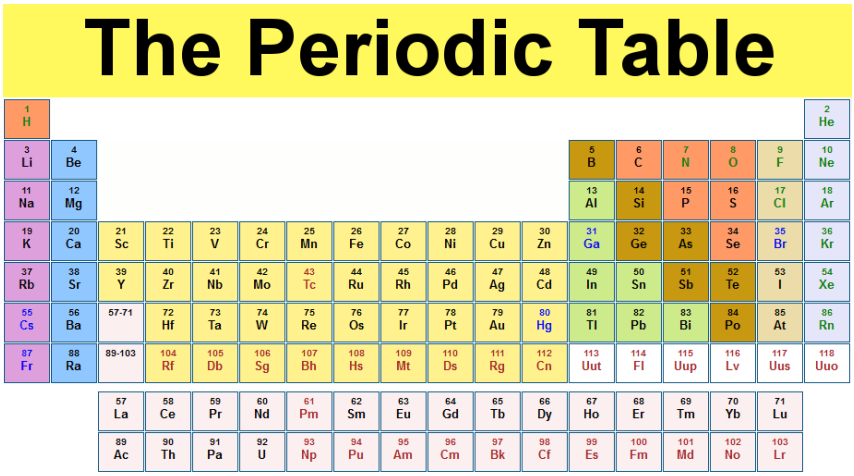
scientist [ˈ sʌ ɪ əntɪ st] учений, науковець

success [səkˈ sɛ s] успіх

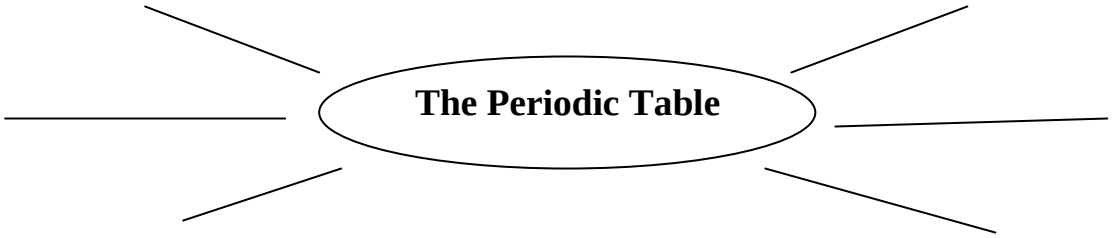
Unit 4

THE PERIODIC TABLE OF THE ELEMENTS

1. Look at the Periodic Table. What comes to your mind?



Complete the chart and share your ideas with your fellow students:



D.I. Mendeleyev

2. Pronounce the following chemical elements (use a dictionary).

Helium, neon, argon, krypton, xenon, scandium, gallium, germanium, lanthanides, actinides.

3. Read the following words and say what Ukrainian words help you to understand their meaning:

Column, position, atomic, proton, pair, vacant, horizontal, period, vertical, group, physical, chemical, gas, metal, organize, illustrate, characteristic.

The Periodic Table of the Elements

The periodic law was accepted immediately after its proposal by Mendeleyev. The scientist **proposed** a periodic table containing seventeen columns, resembling in a general way the present periodic table without the noble gases. In 1871 Mendeleyev **revised** this table and placed a number of elements in different positions, **corresponding to values** of their atomic weights. The atomic number of an element is the number of protons in the nucleus of the atom of that element.

The "zero" group was added to the periodic table after the **discovery** of helium, neon, argon, krypton and xenon.

Most of the elements **occur** in the periodic table in the order of increasing atomic weights. There still remain four pairs of elements in the **inverted order** of atomic weight.

Mendeleyev **predicted** the existence of six elements which had not yet been discovered, corresponding to **vacant places** in his table. Three of these elements were soon discovered (scandium, gallium and germanium), and it was found that their properties are very close to those predicted by Mendeleyev.

The horizontal rows of the periodic table are called periods. The vertical columns of the periodic table are the groups of chemical elements. Elements in the same group are sometimes called **congeners**; these elements have closely related physical and chemical properties. For example, there are inert gases, light metals, nonmetals, lanthanides and actinides.

The modern Periodic Table not only clearly organizes all the elements, it **lucidly** illustrates that they form "families" in rational groups, **based on** their characteristics.

4. Find words or phrases in the text above which are similar in meaning to the following:

a) clear or easy to understand;

b) empty area, space;

c) to set, to use as a foundation;

d) to suggest or to plan;

e) to say that something will happen;

f) to match with; meet the requirements;

g) to read again; to study again;

h) an arrangement of things in a particular order/ in the opposite position;

i) things of the same category;

j) take place;

k) learning or finding something new/for the first time.

5. Use the highlighted words and phrases from the text and complete the sentences.

lucidly	**inverted order**	**discovery**	**congener**	**proposed**
predicted	**based on**	**revised**	**vacant places**	

1. Chemistry students use the periodic table which is ... the atomic number and the physical properties of each element.
2. Mendeleyev ... to reorder elements despite their accepted masses.
3. The arrangement of some elements is done in the ... of their atomic weight.
4. The location of elements in the periodic table ... their ... .
5. A ... refers to a class of combinations with similar structures and chemical properties.
6. Mendeleyev ... the weights and chemical behaviors of some new elements.
7. It ... demonstrates the characteristics of all chemical elements in the periodic table.
8. The ... were left in the table in order to discover and place the missing elements.
9. Scientists made a ... of a large helium gas field in Tanzania.
10. When the periodic table was ... according to atomic number rather than atomic weight, the elements fit their places.

6. Put these words in the correct order to make questions. Discuss these questions in pairs.

1. considered /the "father" /Who /of the modern/ is /periodic table/ to be?
2. Mendeleev/ organize/ in /the elements /How/ the periodic table /did?
3. When /he/ / a number of / place /elements / different /did / in /positions?
4. What / predict/ did/ Mendeleyev?
5. What/ fitted /the vacant /elements/ in the periodic table/ places?
6. What /the rows / are / and / in the periodic /columns /table?

7. Watching a video

Before watching the video:

a) **How far do you agree with the following issues? (Discuss in small groups)**

- There are 90 elements in the periodic table that occur in nature, other elements are man-made.
- The Periodic table has served chemistry students since 1869 when it was created by Mendeleyev.
- Some elements are named after famous people (ex: einsteinium.)
- The elements are technically invisible.

b) **Match the words with the definitions**

1. to arrange	a. the mass of atom of any element
2. work out	b.to put things in a required order
3. value code	c. five non-metallic elements
4. atomic weight	d.to form or connect
5. property	e. the importance or worth of elements
6. link	f. quality or characteristic of something
7. halogens.	g.to arrange or achieve something by resolving different problems

8. Watch the video and concentrate on the missing information.

a) Complete the table.

Metals are found	
	worked out the basis of the modern periodic table
Mendeleyev wrote each element	
Mendeleyev answer was to arrange the elements	
The properties of the elements repeated in	
	based on their position in his table
	a new element called gallium was discovered**.**

b) Look at the tapescript and check yourselves.

9. Answer the questions.

1. How many elements are there in the periodic table?
2. How are the elements with the similar properties grouped?
3. When did Mendeleyev create the basis of the modern periodic table?
4. What game did Mendeleyev like to play?
5. What criteria did he use to arrange chemical elements?
6. Why ‘the periodic table’ is called ‘the periodic table’?
7. What did the scientist leave the space in the table for?
8. Were Mendeleyev’s predictions correct?

10. Listen to the song “The NEW Periodic Table Song (In Order)”. You might repeat the words (chemical elements)

a) Listen to the song again. Fill in the gaps.

The NEW Periodic Table Song

Lyrics

There's _____and _____Then Lithium, Beryllium Boron, Carbon everywhere _____all through the air.

With _____so you can breathe And Fluorine for your pretty teeth _____to light up the signs Sodium for salty times.

Magnesium, Aluminium, _____ Phosphorus, then Sulfur, Chlorine and Argon. Potassium, and _____so you'll grow strong Scandium, Titanium, Vanadium and Chromium and _____.

CHORUS

This is the Periodic Table. Noble gas is stable _____and Alkali react aggressively. Each period will see new outer shells while electrons are added moving to the right.

_____is the 26th Then Cobalt, Nickel coins you get Copper, Zinc and Gallium Germanium and Arsenic.

Selenium and Bromine film While Krypton helps light up your room. Rubidium and Strontium then Yttrium, Zirconium Niobium, Molybdenum, Technetium Ruthenium, Rhodium, Palladium _____-ware then Cadmium and Indium Tin-cans, Antimony then Tellurium and Iodine and Xenon and then Caesium and…

_____is 56 and this is where the table splits. Where Lanthanides have just begun Lanthanum, _____and Praseodymium.

Neodymium's next to_____, then 62's Samarium, Europium, Gadolinium and Terbium Dysprosium, Holmium, Erbium, Thulium Ytterbium, _____ .

Hafnium, Tantalum, Tungsten then we're on to Rhenium, Osmium and Iridium Platinum, _____to make you rich till you grow old Mercury to tell you when it's really cold.

Thallium and Lead then Bismuth for your tummy_____, Astatine would not be yummy_____, Francium will last a little time Radium then Actinides at 89.

REPEAT CHORUS

Actinium, Thorium, Protactinium Uranium, Neptunium, Plutonium Americium, Curium, Berkelium Californium, Einsteinium, Fermium Mendelevium, Nobelium, Lawrencium Rutherfordium, Dubnium, Seaborgium Bohrium, Hassium then Meitnerium Darmstadtium, Roentgenium, CopperniciumUnuntrium, Flerovium Ununpentium, Livermorium Ununseptium, Ununoctium and then we're done!!

b) Find the audioscript and check your understanding.

11. Work in pairs. Make brief notes on the following items. Discuss it with your groupmates.

- the importance of the periodic table in the life/science;
- using chemical elements in everyday life.

12. Make a presentation on the interesting facts about the periodic table.

Transcript

The periodic table includes a place for all the elements that have been discovered. Metals are found on the left and non-metals on the right. Elements with similar properties are grouped together in columns. But the elements haven't always been arranged in this way. It was in 1869 that the brilliant Russian scientist Dmitry Mendeleyev worked out the basis of the modern periodic table. He was a fanatical card player. His favourite game was patience. By Mendeleyev's time 63 elements had been discovered. But scientists couldn't agree on how to arrange them in a useful way. Mendeleyev wrote each element symbol on the card along with the value code, atomic weight. He was determined to find a pattern which would link groups of similar elements. One group was the reactive non-metals: fluorine, chlorine, bromine and iodine. Another group was the reactive metals: sodium, potassium, rubidium and cesium. Mendeleyev was convinced that an overall pattern existed. He tried arranging the cards in different ways. But after three days and three nights he still hadn't found

a solution. Exhausted he fell asleep. Miraculously as he dreamt he began to see the pattern he'd been looking for. Mendeleyev's answer was to arrange the elements in columns in order of atomic weight. By doing this, groups of similar elements could be grouped in the same row like the alkali metals and the halogens. The properties of the elements repeated in series of periodic arrangements. So he called it the periodic table. Mendeleyev was so convinced his pattern was correct that he left spaces. This was his stroke of genius. He reasoned that there was still more elements to be discovered that would fill these gaps. He even predicted the properties of these unknown elements based on their position in his table. If the table really could be used to predict the existence of elements then other scientists would have to agree that Mendeleyev's ideas were right. Six years later a new element called gallium was discovered. Its atomic weight was almost exactly the same as Mendeleyev's prediction. This happened again with two other elements filling gaps. From then on Mendeleyev's table was accepted by scientists.

Today the layout of the periodic table looks slightly different. Well, Mendeleyev wrote his original table in columns, the modern table is arranged in rows. Over 60 elements were known to Mendeleyev. Today we know of more than hundred each with its own place in the periodic table. And nowadays elements are written in order increasing atomic number not atomic weight. The position of any element in this table allows its properties to be predicted.

Audioscript

The NEW Periodic Table Song (In Order)

Lyrics

There's Hydrogen and Helium. Then Lithium, Beryllium Boron, Carbon everywhere. Nitrogen all through the air.

With Oxygen so you can breathe. And Fluorine for your pretty teeth. Neon to light up the signs Sodium for salty times.

Magnesium, Aluminium, Silicon Phosphorus, then Sulfur, Chlorine and Argon Potassium, and Calcium so you'll grow strong Scandium, Titanium, Vanadium and Chromium and Manganese.

CHORUS

This is the Periodic Table. Noble gas is stable. Halogens and Alkali react aggressively. Each period will see new outer shells while electrons are added moving to the right.

Iron is the 26th. Then Cobalt, Nickel coins you get Copper, Zinc and Gallium Germanium and Arsenic.

Selenium and Bromine film while Krypton helps light up your room. Rubidium and Strontium then Yttrium, Zirconium, Niobium, Molybdenum, Technetium Ruthenium, Rhodium, Palladium Silver-ware then Cadmium and Indium Tin-cans, Antimony then Tellurium and Iodine and Xenon and then Caesium and…

Barium is 56 and this is where the table splits. Where Lanthanides have just begun Lanthanum, Cerium and Praseodymium.

Neodymium's next to Promethium, then 62's Samarium, Europium, Gadolinium and Terbium Dysprosium, Holmium, Erbium, Thulium Ytterbium, Lutetium.

Hafnium, Tantalum, Tungsten then we're on to Rhenium, Osmium and Iridium Platinum, Gold to make you rich till you grow old Mercury to tell you when it's really cold.

Thallium and Lead then Bismuth for your tummy Polonium, Astatine would not be yummy Radon, Francium will last a little tim, Radium then Actinides at 89.

REPEAT CHORUS

Actinium, Thorium, Protactinium Uranium, Neptunium, Plutonium Americium, Curium, Berkelium Californium, Einsteinium, Fermium Mendelevium, Nobelium, Lawrencium Rutherfordium, Dubnium, Seaborgium Bohrium, Hassium then Meitnerium Darmstadtium, Roentgenium, Copernicium

Ununtrium, Flerovium Ununpentium, Livermorium Ununseptium, Ununoctium and then we're done!!

Vocabulary 4

accept [ək'sept] 1) приймати 2) припускати; погоджуватися

add [æd] додавати, прилучати, складати

arrangement [ə'reɪ nʤmənt] 1) приведення (доведення) до ладу; впорядкування 2) розташування; класифікація

congener [kən'ʤiː nə] споріднена річ

increase [ɪ n'kriː s] зростати; збільшувати(ся); посилювати(ся)

invert [ɪ n'vɜ ː t] перевертати; переставляти

lucid ['luː sɪ d] ясний, прозорий

nucleus ['njuː klɪ əs] (nuclei) 1) ядро; центр 2) атомне ядро

order ['ɔ ː də] порядок; послідовність

predict [prɪ 'dɪ kt] провіщати, передрікати

propose [prə'pəuz] пропонувати

requirement [rɪ 'kwaɪ əmənt] 1) вимога; необхідна умова 2) потреба

remain [rɪ 'meɪ n] залишатися

revise [rɪ 'vaɪ z] 1) виправляти; перевіряти 2) переглядати

value ['vælјuː] цінність; важливість

weight [weɪ t] вага; маса

Unit 5

MATTER

1. Discuss these questions in pairs.

a) What is the difference between a stone, juice and a ball?

b) What states of matter do you know? Give examples.

c) What does matter consist of?

2. Read and practice the pronunciation of the following words.

chemist ['kemɪ st] 1) хімік 2) аптекар

liquid ['lɪ kwɪ d] рідина

evaporate [ɪ 'væpəreɪ t] 1) випаровувати(ся), згущати(ся)

solid ['sɒ lɪ d] тверде тіло

to obtain [əb'teɪ n] існувати, здобувати

liquefy ['lɪ kwɪ faɪ] перетворювати(ся) на рідину

molecule ['mɒ lɪ kju: l] молекула

to be converted [kən'vɜ ː tɪ d] бути перетвореним на

vapour ['veɪ pə] пара

vaporize ['veɪ pəraɪ z] випаровувати(ся)

3. Read the text and pay attention to the highlighted words and phrases.

MATTER

It is common knowledge that matter may **exist** in three physical states (solid, liquid and gas). It is usually possible to change matter from one state to the other by changing its temperature. For instance, a piece of ice is called a solid; it may melt and form a liquid; as it **evaporates**, liquid water changes into a vapour, i. e. into the **gaseous state**.

Many kinds of matter, like water, can be obtained in each of the three states; for some, however, extraordinary means have to be used in order to produce one, or even two of the states; and for others, only two states are known or can be produced.

Common salt, for example, exists normally as a **solid**; at a temperature of several hundred degrees, it can be liquefied; and at still higher temperature it is converted into vapour. Carbon, a solid under normal **conditions**, can be vaporized, but it has never been liquefied.

Solids have both a definite volume and **a definite shape**. Liquids, too, have a definite volume, but they take the shape of their containers.

Gases have neither a definite shape nor a definite volume. A chemist must have a thorough knowledge of the states of matter and of physical laws that **govern the behaviour** of matter in various states.

It is known to everybody that all matter is **composed of** molecules. The question which must be answered, then, is: if all matter is composed of molecules, what is the essential difference between the states of matter? The answer to this question is that the **essential difference** between these states is the relative quantities of energy molecules possess in different states.

4. **Match the highlighted words and phrases to their definitions.**

a) to change from one physical state to a vapour;

b) a form of something;

c) important distinctive feature;

d) to be, to live;

e) to influence the way a person acts;

f) hard and not a gas or liquid;

g) to form, to consist of;

h) to be of the form of gas;

i) a way of living, existing.

5. **Choose five highlighted words from the text and make up your own sentences.**

6. According to the text, what…

1. three physical states do you know?

2. is called a solid?

3. can be changed into the gaseous state?

4. matter can be obtained in three states? Give examples.

5. matter has a definite volume?

6. takes on the size of containers?

7. is the distinctive characteristic of gases?

8. is the matter composed of?

7. Complete the sentences by putting the correct form of the word in brackets into each gap.

1. ... matter is also known as vapour. (GAS)

2. ... natural gas is usually warmed for making natural gas and used in cooking.(LIQUID)

3. Scientists think that liquid can keep its volume when it changes a ... .(CONTAIN)

4. Boiling water leads to its ... .(VAPORIZE)

5. The Austrian-Swedish ... , Lise Meitner, discovered the element protactinium. (MATH)

6. There are two main types of matter properties: physical and ... .(CHEMISTRY)

7. Transfer of one or more species from the gas phase to a liquid solvent is also called gas ... or gas scrubbing. (ABSORB)

8. There are two main types of biochemical ...: reduction and oxidation. (REACT)

8. Work in pairs. Rearrange the words to make the sentences.

1. Heat /destroy/ a / system / can /biochemical.

2. In liquids, /move /around /each other /and /the molecules/ slide /past.
3. Plasma /atoms /exists /when /are/ in /an excited state.
4. Thermal / solids,/ can be /energy /transferred /through /liquids and gases.
5. The solids / and / particles:/ atoms, /consist of/ ions /molecules.
6. Liquid / do not have /such/ strong /molecules / restoring force /as solids.
7. Gas /behave /like /molecules / are /independent of one / they /another.
8. When/ it /ice /melts, /a piece of/ forms / a liquid.
9. Salt /as a solid,/ exists / can / but it also / be / liquefied.
10. The/ in/ molecules/ move /randomly/ a material.

9. Put the paragraphs into their most logical order

We know about solids, liquids, gases and plasmas. One state is called the Bose-Einstein condensate (BEC). Scientists have always known about solids, liquids, and gases. Plasma was a new idea. It was identified by William Crookes in 1879. The scientists who worked with the Bose-Einstein condensate received a Nobel Prize for their work in 1995.

In 1932, scientists discovered that the nucleus of an atom is made of smaller particles. They are called protons and protons neutrons. Protons carry a positive charge. Neutrons have no charge at all neutrons. Protons and neutrons are called nucleons as they are found in the nucleus. When they were discovered, scientists thought they were the smallest pieces of matter.

In 1911, Ernest Rutherford discovered that atoms are really made of a positively charged center called the nucleus orbited by negatively charged particles called nucleus electrons.

Everything that has mass and takes up space is called a matter. There are some things that do not consist of matter, for example, time, heat, sunlight, rainbow etc. Thus, matter is sometimes related to light and electromagnetic radiation. Matter can

be found all over the Universe. It is possible to find it in a few forms on Earth. There are five states of matter . Each of those states is called a phase.

10. Look through the text again and compose three special questions. Ask your neighbours.

11. Agree or disagree with the following statements

- Water is the only substance that is found naturally on Earth in three forms.
- Matter behaves differently.
- Liquids cannot be handed to another person without the container.
- Matter can move from one state to another and can’t be the same substance.
- “Human nature is like water. It takes the shape of its container.” *Wallace Stevens*

Vocabulary 5

behaviour [bɪ 'heɪ vɪ ə] поведінка

charge [ʧ ɑ ː ʤ] заряджати

gaseous ['geɪ zɪ əs] газовий; газоподібний

neutron ['nju ː trɒ n] нейтрон

orbit ['ɔ ː bɪ t] обертатися (рухатися) по орбіті

particle ['pɑ ː tɪ k(ə)l] частка; крихта

quantity ['kwɒ ntɪ tɪ] кількість, величина

receive [rɪ 'si ː v] 1) одержувати, отримувати 2) приймати

shape [ʃ eɪ p] форма;

state [steɪ t] стан, будова, структура, форма

substance ['sʌ bstəns] речовина

Unit 6

MOLECULES

1. Before you read the text, look at the following quotation. Do you agree with it?

"Almost all aspects of life are engineered at the molecular level, and without understanding molecules we can only have a very sketchy understanding of life itself". – *Francis Crick*

2. Practice the pronunciation of the following words.

chemist ['kemɪ st] 1) хімік 2) аптекар

occur [ə'kɜ ː] відбуватися

undergo [ˌ ʌ ndə'gəu] (underwent, undergone) зазнавати, зносити, переносити

chlorine ['klɔ ː ri ː n] хлор

molecule ['mɒ lɪ kju ː l] молекула

aggregate ['ægrɪ gɪ t] 1) сукупність 2) агрегат

density ['densɪ tɪ] 1) густота, щільність

substance ['sʌ bstəns] речовина

compound ['kɒ mpaund] суміш; сполучення, сполука

diatomic [ˌ daɪ ə'tɒ mɪ k] двоатомний

sulphur ['sʌ lfə] сірка

helium ['hi ː lɪ əm] гелій

MOLECULES

To the modem **chemist**, the atom is the smallest particle of an element that can enter into a **chemical reaction**. Thus, each element has atoms that are peculiar to itself and different from those of each of the other elements. Chemical reactions occur when atoms of different kinds unite to form groups in which they bear definite relationships to each other or when these groups undergo **disruption** or rearrangement. Chemical unions are of two general types.

In one type of union, atoms **become bonded** together to form definite aggregates that exist as independent, electrically neutral particles and are known as molecules (Latin “little mass”). Some elements have atoms that unite with others of their own kind to form molecules. These are known as elemental molecules and arc exemplified by the chlorine molecule which is made up of two chlorine atoms. Compound molecules **are composed of** two or more kinds of atoms and are exemplified by the water molecule, which contains two atoms of hydrogen and one of oxygen.

To give a short definition of a molecule is not to give a more or less full account of properties. Molecules are regarded as the smallest particles or elementary **substances** that can have independent existence. They account for the chemical properties and at least some of the physical properties of the substance they **constitute**. A single molecule does not exhibit in full the physical properties commonly associated with its particular variety of matter. These properties arise both within the molecule itself and within the aggregates of like molecules that constitute a sample of the given substance. The **density** of water depends not only on the mass and volume of individual molecules but also on the manner in which the molecules are packed together. Since the chemist works with the aggregates, their properties are of great **practical importance**.

A molecule of a compound contains, of necessity, at least two different atoms. An element molecule may contain only one atom, or it may contain two or more. Helium has monoatomic molecules; chlorine and hydrogen each exist as diatomic molecules; and sulphur molecules contain eight atoms. During reactions the atoms of elemental molecules usually are separated and individually **redistributed** in new combinations.

3. Read the text and give Ukrainian equivalents to the following words and expressions. Use them in the sentences of your own.

Chemical reactions, physical properties, chlorine molecule, independent existence, exemplify, substance, mass and volume, diatomic molecules, sulphur

molecules, neutral particles, rearrangement, Helium, disruption, monoatomic molecules, contain, occur, aggregates, hydrogen.

4. Find the highlighted words in the text. Match them with the correct meaning below.

a) to tie or connect some things together

b) a person who studies chemistry or a scientist who is engaged in chemical research

c) physical quantity that defines mass ratio to volume

d) significance of pragmatic or realistic doings

e) to arrange or move things again or differently

f) condition or matter that can be solid, liquid, gas

g) consist of

h) a process that can change structure and direction of different elements

i) to arrange/to form/to construct

j) destruction/breakdown

5. Look through the text and decide which word or phrase is best for each space.

chemical properties	**density**	**chemists**	**redistributed**
constitute	**molecule**	**atom**	**measure the volume**

1. … is a small part of an element.
2. … analyze substances, conduct experiments and write different reports on chemical processing.
3. The ions put together by the dissociation of any … are of two kinds.
4. People study … of different things and materials in order to develop new goods.
5. Boats and ships can float on the water because of the difference between mass and….

6. Oxygen, carbon, hydrogen, nitrogen, calcium and phosphorous … our body.
7. It is difficult to … of a liquid because liquids can change their shapes.
8. The atoms of molecules can be … in various combinations.

6. Match two halves of the sentences

1. Chemical changes
2. Melting, boiling and
3. Chemists investigate the aggregates
4. Dehydration synthesis is a chemical reaction that involves molecules
5. Chemical bond is a process of
6. Hydrocarbons are organic molecules
7. Chlorination is a method of water
8. Diatomic molecules are made up of identical elements

a. to form larger and complex molecules.
b. evaporation are the physical changes
c. that consist of carbon and hydrogen.
d. and are called diatomic elements.
e. linking elements (atoms) in molecules by electrical force.
f. can form new substances.
g. disinfection and is used all over the world.
h. that are of great practical importance.

7. Define true or false sentences.

1. Atom takes part in aggregation.
2. Atoms join with others of different kind to form ions.
3. Polymer molecules may contain many thousands of component molecules.
4. Chemical bonds are interactions that separate atoms in chemical elements.
5. The density of water depends on the mass and volume of compounds.
6. Diatomic molecules consist of five atoms that are chemically unbound.

7. Diatomic molecules are formed by two elements.

8. Chemical compound is a substance made up of different molecules.

9. The halogens are elements that form sulphur molecules.

10. Water is made of glucose and carbon.

8. Put these words in the correct order to make questions. Discuss them in pairs.

1. What /atom /consist/ does /of?

2. is /What/ molecule /a?

3. How/ are/ bonded /atoms /to /a molecule/ form?

4. When / the chemical / the molecules/ reactions /occur/ between / do?

5. What/ the/ chemical reactions/ characteristic /are/ features of/ the?

6. What / the physical /the substances /properties /are /of?

7. How /we/ different /define/ the density /do /of /substances?

8. What / happen/ molecules/ to /the / during/ the /can /reactions?

9. Read the following issues. Choose one and discuss it in small groups.

- Chemical reactions in our everyday life.
- Influence of physical and chemical reactions on food industry.
- The role of chemistry in our present day life.

10. Find some information and make a report on the following issues (15 sentences)

1. "The power of sunlight and coal, electric power, water power, winds and tides do the work of the world, and in the end all unite to hasten the merry molecular dance". – *Frederick Soddy.*

2. "Chemistry begins in the stars. The stars are the source of the chemical elements, which are the building blocks of matter and the core of our subject". – *Peter Atkins.*

3. “In those days industry would hire any chemist that could breathe”. – *William Standish Knowles*

Vocabulary 6

breathe [briː ð] дихати

core [kɔ ː] ядро, суть

characteristic [ˌ kærɪ ktə'rɪ stɪ k] характерний

chemical ['kemɪ k(ə)l] хімічний

definite ['defɪ nɪ t] визначений; певний

density ['densɪ tɪ] густота, щільність

dissociation [dɪ ˌ səuʃ ɪ 'eɪ ʃ (ə)n] роз'єднання; відмежування

dehydration [ˌ diː haɪ 'dreɪ ʃ (ə)n] збезводнювання, зневоднення

evaporation [ɪ ˌ væpə'reɪ ʃ (ə)n] випарювання, випаровування

existence [ɪ g'zɪ st(ə)ns] існування

exemplify [ɪ g'zemplɪ faɪ] 1) ставити за взірець, бути прикладом 2) наводити приклад

feature ['fiː ʧ ə] особливість, характерна риса; ознака, властивість

hasten ['heɪ sn] 1) прискорювати, пришвидшувати 2) поспішати

hire ['haɪ ə] наймати

hydrogen ['haɪ drəʤ(ə)n] водень

interaction [ˌ ɪ ntər'ækʃ (ə)n] взаємодія, взаємодіяння

investigate [ɪ n'vestɪ geɪ t] досліджувати; вивчати

melt [melt] топити(ся); розчинятися

synthesis ['sɪ nθɪ sɪ s] (syntheses) синтез

substance ['sʌ bstəns] речовина

unbind [ˌ ʌ n'baɪ nd] (unbound) 1) розв'язувати; розпускати 2) звільняти, визволяти

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